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WORKING PAPER
ALFRED P. SLOAN SCHOOL OF MANAGEMENT

BEYOND THE BOUNDARY: MANAGING EXTERNAL
RELATIONSHIPS IN NEW PRODUCT TEAMS

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WP1805-86

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NOV 20 1986

ABSTRACT

The basic premise of this paper is that boundary management is a critical predictor of team performance, particularly for those teams that are dependent on resources found outside their borders. Using interview data from a set of new product teams, the paper describes a set of boundary behaviors carried out at different stages of product development. Propositions linking boundary behavior and team performance at different phases of development are introduced.

Abstract

The results presented in this report are the outcome of a study of the effect of the type of stimulus on the response of a group of subjects. The subjects were divided into two groups, one of which received a stimulus of a certain type, and the other a stimulus of a different type. The results of the study are presented in the following table, which shows the mean response of the subjects in each group for each type of stimulus. The results indicate that the response of the subjects is significantly affected by the type of stimulus, and that the response is generally higher for the stimulus of one type than for the stimulus of the other type. The results also indicate that the response of the subjects is generally higher for the stimulus of one type than for the stimulus of the other type.

It is unfortunate that, at the very time research on group process is on the wane, the use of groups in organizations is increasing (Goodstein & Dovico, 1979). Tasks that once were performed by individuals are assigned increasingly to groups, because the tasks are complex, and producing results requires combining information and expertise from diverse sources. The group literature that does exist focuses primarily on internal group processes such as decision making and problem solving, on groups engaged in simple tasks, and on cross-sectional data. This orientation does not fit the reality of organizational task groups, managing external as well as internal processes, that is the focus of this paper.

The basic assertion of this paper is that the management of external relationships (henceforth called boundary management) is a critical predictor of team effectiveness. This is particularly true of a team that must engage in exchange relationships with many other actors both inside and outside the organization, in order to obtain information and resources (Spread, 1984). Boundary management is essential for a team that does not control all the critical resources needed to accomplish its task. Applying the resource dependency perspective (Pfeffer & Salancik, 1978) such a team is not autonomous but rather constrained by a network of interdependencies with other parts of the organization and the external environment. This interdependence, when coupled with uncertainty about what actions those other parts of the organization will take, leads to uncertainty about the survival and success of the focal team. Therefore, a team must take action to manage external interdependencies. These actions lead to new patterns of dependence and interdependence that require ongoing boundary management (Pfeffer, 1985).

Our second assertion is that the amount and type of boundary behavior needed for high team performance changes over time. Previous research has tended to take a cross-sectional view of groups rather than an evolutionary or developmental perspective. In many organizational groups, however, task demands and resource dependencies often shift over time. Group processes change to meet evolving demands.

We use new product teams to represent groups facing complex and critical interactions with others, and we explore the relationship between their boundary processes and group effectiveness over time. First we review the literature on boundary processes. This is followed by a summary and critique of research on group development. Finally we present data from new product teams to highlight the role of effective boundary management in team success.

Boundary Processes in Groups

Internal group processes are complemented by external processes, or interaction with the environment that surrounds the group (Alderfer, 1976; Cummings, 1978). A study by Gladstein (1984) showed that in ongoing organizational sales teams members focused on two major set of activities: intragroup processes and boundary processes, rather than the traditional task and maintenance activities. These external or boundary spanning processes may take the form of procuring resources, working out interdependencies, or transferring group output to others (Alderfer, 1976; Quinn & Mueller, 1963).

Research on boundary processes has focused primarily on individual and organizational levels of analysis. Research at the individual level has concentrated on the characteristics of boundary spanners (e.g., Caldwell & O'Reilly, 1982) and the role conflict these individuals experience (Adams,

1976; Keller & Holland, 1975; Organ & Greene, 1974). Organization-level research has addressed processes by which organizations adapt to their environment by selecting, transmitting, and interpreting information originating in the environment (e.g., Aldrich & Herker, 1977; Child, 1972).

Fewer studies of boundary management have been done at the group level. This is surprising because groups, like organizations, are open systems that must manage their relationships with the external environment. Moreover, much of this research has been done with laboratory groups or with T-groups that work in isolation. Such groups seldom have complex tasks or interact with others. Most groups in organizations must interact with interdependent others to obtain resources, to coordinate work and decisionmaking, and to exchange inputs and outputs (see Figure 1 for a comparison of groups working in isolation and groups working in the organizational context). Such "real" groups may carry out the organization-environment boundary spanning activities that are required for their task (Thompson, 1967).

Insert Figure 1 About Here

One set of group-level boundary spanning studies examines the pattern of work-related information flow in R & D laboratories (e.g., Allen, 1984; Katz, 1982; Tushman, 1977, 1979). In general, these studies found a relationship between the input of information by boundary spanners and performance in the group. For example, high-performing R & D project groups showed far greater communication with organizational colleagues outside the group than low-performing teams (Allen, 1984). In addition, communication followed a two-step process, with communication "stars" first getting the information from outside and then translating the information and transmitting it to the group (Tushman, 1979).

Most of the group-level research on boundary spanning has been limited to studying how members bring technical information into the group. Exchange theory and the resource dependence perspective would suggest, however, that when a team is part of a system organized by an interconnecting web of relationships, a broader conceptualization of boundary spanning is needed (Bagozzi, 1975; Brinberg & Wood, 1983; Tichy & Fombrun, 1979). For example, boundary activity can be categorized not simply by the transfer of technical information, but also by whether political and organizational information, goods and services, affect and liking, ideas, and/or power and influence flow into and out of the group. Similarly, group members are not the sole initiators of transactions; outsiders often initiate transactions, and group members may play a reactive role in responding to external initiatives.

This broader conceptualization raises many research questions: What is the range of boundary behaviors that groups use to maintain their transactions? What triggers these behaviors --habit, resource dependency, failure? With what result? Given the paucity of answers to these questions we have tried to identify the internal and external behaviors of new product teams in a resource-dependent context in order to generate some propositions about the link of boundary behaviors to team effectiveness.

Team Development

Team development has been modeled as a sequential process having four stages: 1) individuals become oriented to the group and determine roles, 2) conflict develops as group members struggle for leadership in the group, 3) members agree on norms and rules, and 4) work leads to completion of the task (Heinen & Jacobson, 1976).

This view of development focuses on two of the four functions in Parsons' (1959) functional analysis of social systems: integration and pattern maintenance. Integration refers to the coordination of effort, hierarchy, workflow, and procedures, or in group terms, work norms and roles. Pattern maintenance refers to reducing tensions in the system through the establishment of values to guide behavior, and attempts to satisfy members.

Left out of the current models of development from a resource dependence perspective is the need to carry out the external functions identified by Parsons (1959): adaptation and goal attainment. Adaptation is the procurement and deployment of resources and gaining environmental support to achieve goals. Goal attainment involves defining goals and evaluating progress towards them. Goals here are not ones of efficiency or satisfaction within the group but rather effectiveness, demonstrating to those outside the group what has been accomplished (Lyden, 1975). Because most organizational groups are open systems that are dependent upon other parts of the organization and environment, we need to add adaptation and goal attainment to our developmental models of groups.

This perspective yields many research questions: How do external roles get carried out in conjunction with internal ones? Which functions, and therefore roles are most critical over time? How do boundary roles help to carry out the external functions of adaptation and goal attainment?

New Product Teams

This paper addresses the research questions described by examining new product teams in organizations. A new product team is a set of interdependent individuals who view themselves as a team, and who are responsible for the

development and introduction of products outside the existing product line (Alderfer, 1976; Flesher, Flesher, & Skelly, 1984). A new product team depends on the resources of many other parts of the organization and must coordinate with myriad other functions such as marketing, manufacturing, and sales. The nature of these interdependencies shifts over time as the focus moves from an idea to a completed product.

New product teams are more than an example of evolving, highly interdependent task groups. They serve important functions for many organizations. Business experts, for example, note that the contribution of new products to sales growth is expected to increase by one-third during the 1980s while the portion of total company profits generated by new products is expected to increase by 50 percent over the next five years (Booz, Allen & Hamilton, 1982). Reliance on new product success is particularly prevalent in high-technology industries. There is a push from both government and industry "not just to produce more technical innovation, but to produce it more quickly and efficiently" (David, 1984, p. 57).

We assert that boundary management is one of the important predictors of new product team effectiveness. An examination of the boundary activities and internal processes of new product teams over time can tell us about the link between process and effectiveness. Given that our goal is to learn more about general group processes, not identify all the factors related to product development, we do not attempt exhaustive literature review of new product development or discuss data unrelated to group process.

Methods

The findings of this paper were derived both from a review of the present literature and from over 100 hours of interviews with new product team managers and members at six corporations in the computer and integrated circuits industries. Four team leaders were interviewed for three to ten hours, from within a week to six weeks after the completion of their projects. We asked these managers how their new product teams were set up, how the teams evolved over time (including key events, crises, and tasks), and how the teams coordinated their efforts with other groups. After the descriptive data were collected, we asked team leaders what they saw as important factors for success of a new product team. A fifth team leader was interviewed every four to six weeks over a twenty month period to get a more fine-grained view of the development process. Finally, four managers of multiple new product teams, four new product team leaders, and six members from a set of other teams were interviewed during the early and middle phases of product development to get a further description of team activities. Examples of the types of products the teams were working on ranged from engineering work stations to computer interconnects.

This sample is not meant to be representative or large enough to test hypotheses. Rather data from the interviews is used to augment current group theory by identifying the range and importance of boundary activity, and trying to discover patterns of activity that may lead to success. So we have followed a comparative case analysis approach. This research strategy was chosen because we believe that the research on group process in organizations is at an early stage of development. Hence, that research will benefit if the following research activities precede hypothesis testing: 1) exploration and description (creating a data base), 2) cataloguing and classification (developing a taxonomy), 3) extension of observation into generalized patterns (defining

sub-system laws), and 4) proposing hypotheses (suggesting causal mechanisms) (Gladstein & Quinn, 1985).

Stages of New Product Development

The key to the success of new product teams is to meet the task demands at each phase of product development. This requires that the group be able to effectively obtain information and resources from external sources, process the information and resources internally, and use those inputs to create and gain acceptance of a viable product (Burgelman, 1983). Research on new product management has identified six phases of new product development and introduction assuming that a new product strategy is in place. These six phases include: idea generation, screening and evaluation, business analysis, development, testing, and commercialization (Booz, Allen & Hamilton, 1982; Urban & Hauser, 1980).

While the Booz, Allen & Hamilton phases outline what must be done to develop and produce new products successfully, they do not specify what the group must do to in order to get the product through these phases. In addition, they portray the process as linear, while our observations and other research indicate a more cyclical process. Burgelman (1983), for example, indicates that the process may cycle through several times, involving several hierarchical levels and numerous functional groups.

In our data we identified three phases of activity separated by two transition points: creation (transition from possible to definite product); development (transition through technology transfer); and diffusion and ending (see Figure 2). Each phase has different internal and external demands. Here we provide excerpts from interviews to characterize the particular phase and briefly interpret the data.

The Creation Phase

I joined the company in July 1984. I was hired to take on this product since I had some experience in the low end of the market and detailed knowledge of issues of compatibility. The company had a product on its mind, at least there was an idea. There had been an off-site meeting fifteen months before with top level people--the CFO and numerous R&D VPs. The purpose had been to set a direction for the new product, but they got into details because they had to.

The first thing I did was to go to talk to lots of people to find out what they thought the product was and how to get there. This was at the technical level, what are the details, not just global suggestions. I started out with the guy who brought me here, he sent me to see someone else, and so it went that I came to talk to a lot of high- and middle-level people. The interviews were open-ended but I pushed and maybe even taught them a few things about their concept: what it meant to produce the product they envisioned. So I gained knowledge about details of what the product ought to be, who the players were, what they did, and what they wanted. I spent the first month on the job doing these interviews.

We actually began in September, when a representative from marketing, two from software, and one from hardware were assigned to the program. So the product vision and buy-in were somewhat there before I came in. People were ready to expend resources, and the culture supported the team idea. By mid-September we were hiring more people and identifying resources that were needed. By now we would meet as a single group every Monday morning. The purpose of the meetings was to take the concept and refine it into a real product. The first three months, September through November, were spent deciding what the product could be, and getting resources. Resources weren't really a problem since top management was pushing this one.

----New Product Team Leader

It's not exactly clear how the whole thing got started, but then it seldom is. I had been very busy talking to top management and studying the technology and the competition and thinking about the next generation of products. There were these two other projects going on, but they weren't doing too well. So about a year ago the Product Committee (top-level product strategy group) decided to start this new project. It was critical to the strategy of the company to produce something with a much higher performance level than anything we'd done before. And they came to me to run the team.

The first thing to do was obviously to get the two former team leaders signed on. They almost said no, after all they were losing control, but in the end they did it. Then we started out by having a meeting with the two old project teams, and members

of the top corporate and division management. The CFO explained that we needed everyone's help to get back into position with this product. This was May and we were supposed to have this wonder machine ready to ship by January. These were big stakes. This was important to the company. And with the pep talk we were off. I was the project leader, the CFO was our Godfather and the R & D VP was our helper. After the two former leaders were signed up for the project I pulled in two more key people and had an initial meeting. This was the core of the group, one person in charge of software, hardware, microcode and systems. We would hold the group together. We added a few more people and then spent a couple of weeks frittering about, reading stuff, deciding if the product was feasible. People were saying "no way it can happen" and I was busy setting things up so we'd have a place to live.

We moved in and launched into work. Those first two weeks we lived in the conference room. We were meeting everyday and went out to dinner a lot. We dealt with technical issues and there were lists of issues to explore everywhere. People would go off and prepare a report or alternatives and implications of various design issues and we would offer opinions. They had more information than I did so they made the decisions. After two weeks of this we were a team. We made most of the major decisions in those two weeks, and then spent much less time together. There were, of course, weekly meetings and ad hoc meetings for problem resolution. If a problem couldn't be solved in a meeting it was put on a list and taken care of later."

-New Product Team Leader1

Several activities appear to take place across the team's boundary in this early creation phase. The groups collect large amounts of information: technical information about what is and is not feasible, and what the latest innovations have been, market information about what products are selling well and what the competition is doing, and political information about who supports the project and who does not. At this time the group may also be attempting to determine what the people in power want the product to be and how the product fits into the corporate product strategy. The group, or at least some representative of the group may also be trying to gain support for the product by getting an early commitment and cooperation from groups whose support may be needed in the future.

This selling of the project idea and laying the groundwork for future communication and commitment has been described elsewhere as "necessary to demonstrate that what conventional corporate wisdom had classified as impossible was, in fact, possible" (Burgelman, 1983, p. 232). Thus, the teams demonstrate two major activities: bringing information into the group in order to model the demands and resources of the external environment, and communicating with that external environment in an attempt to shape it according to the group vision. In addition, the group is bringing in resources in the form of people, money, equipment, and promises.

This description of early team activity is consistent with group research that takes a resource-dependent perspective. Friedlander and Scott (1981) found that work group activities were "legitimized" and were more likely to be implemented when there was a back-and-forth flow of ideas with top management. Such liaison activity is predicted to aid in integration and support from all interdependent groups (Friedlander, 1984). Baker (1986), in a study of new product teams found that products that the company had less experience with required groups to secure an increased amount of top management support.

In addition, once a work or information channel is established, over time it tends to be used for other unrelated purposes (March & Simon, 1958) so that outsiders who are given information early may well reciprocate with assistance for the team. Finally, voluntary coordination is said to require (in the outside group) a positive attitude toward coordination, a recognized need for coordination, knowledge of the focal group as a good potential partner, an assessment of the focal group as compatible, and a capacity for maintaining coordination links in both groups (Whetten, 1983). Activities of the teams in this study seem to be consistent with the research.

Not only do teams manage their boundaries by altering what takes place across these boundaries, but they also alter the permeability of these boundaries. That is, one design tool the manager uses is how open the boundary is. Note that at this phase the "group" may shift from an engineer working with top management, or other parts of the organization in a loose information-sharing mode, to a set of cross-functional people actually designing the product. During the Creation phase the team may change both through expansion and a shift in composition. The creation phase is often unstructured: a product idea can come from various sources, the origin of the idea often cannot be clearly identified, and the idea may exist in multiple parts of the organization for long periods of time before someone formalizes its development.

The group is not solely negotiating across its boundaries. There is a great deal of internal activity in the creation stage as well. Just as some strategic decisions do, the team's process of defining the product appears to proceed incrementally (Quinn, 1982). The original product idea may be very general but the team works to collect information so that a greater level of specificity is achieved (see Figure 2). Thus, the team needs to define the product, determine feasibility, and figure out how to work together to do this. In addition, team members must be chosen and integrated into the group.

Possible to Definite Project: A Transition Point

The design review was set up to make sure we weren't going off in crazy directions. All of R&D was invited, quite a few showed up. I ended up with two pages of questions that people had. We had answers to most of them, and we got lots of helpful input. We were official now, they had given us the OK. We went back to work.

-New Product Team Leader

The first sell was to the R&D staff, in September. We as a group had decided what we wanted to do and we had to get them to agree, the VPs had to sign off. We're spending their money, we have to meet their needs to keep getting resources. I presented the team's ideas and we got lots of comments. Two weeks later there was another meeting to discuss our progress and refinements of the first meeting. This was to a broader audience, we were seeking the blessing of top management. Several issues were raised and we went back to the drawing board. Three weeks later we had another meeting to make decisions about the open issues. This meeting was with high levels of R&D, marketing and manufacturing—all the players required to make decisions. One big issue was PC compatibility—and although we closed on other things this issue remained open, we couldn't decide. I wish we had because now this is causing some delay, but no agreement was reached.

-New Product Team Leader

Management just couldn't all get together and decide which chip they were going to use. It was debated and changed and debated and we couldn't really get working. The cost and time to delivery got out of control. We had to scrap the whole thing and most of the team left the company.

-New Product Team Member

We had the machine designed already and it looked like it was going to do just what we wanted it to do. But no one would sign off on it. It took months and months, and so many meetings. One of the VPs said he didn't want to see me anymore. But we just kept on plugging away at it and finally we got permission to go ahead in a major way. I think this guy just got tired of seeing all my phone messages.

-New Product Designer

There appear to be certain transition points that serve to define or segment the rather messy, circular new product process. These transitions seem to be like hoops or challenges; if they are not achieved to a particular specification, organizational support for the group and its product may be withdrawn and the group disbanded (as in one example above). If, however, the group does receive support it moves on to a different set of activities, a different status, and perhaps adds different members. These transition points serve to organize and focus group activities, often marking a shift in the group's process.

In most of the teams that we spoke to, the first of two transition points occurred just prior to the major portion of the development phase, so we call it a shift from a "possible" project to a "definite" project. Crawford (1983) describes a similar shift from a recognition of potential feasibility to commitment to one new product idea. This entails movement from low-cost effort with minimal organization response to major capital investment and commitment from top management. In our sample there was usually some formal, organizationally imposed, design review that forced the new product group to present and defend its design. Even when this was not the case, there was usually informal organizational pressure to brief top management and get their support. Teams described spending a great deal of frenzied time and activity preparing for these reviews. Two teams that could not make this transition had either delays or failure.

Development

By now we were up to July. I would go back to the company once a week for a staff meeting with my boss and bring my people "letters from home." I would report back to them on things that might be of interest. This was also a chance to see what was going on in other areas. There was a lot of coordinating to do. I wanted to make sure that components were ordered and the printed circuit boards were out. George was the liaison to manufacturing, but I needed to check on things every once in awhile. We had decided to build a mini manufacturing facility. There was a lot to watch over so we decided to bring in three people from manufacturing. Later we would bring more manufacturing people in to help with the debugging, but these guys became part of the team. The manufacturing people helped with the components decisions: which could be obtained, did they have the right performance specs.

In early August we hired four contract workers and started having project status meetings where we would list all the problem areas and who would do what, when. At this point we also started meeting with people outside the group to provide a status update. We had representatives from purchasing, larger manufacturing areas, production planning, diagnostics, and marketing. There were twenty to thirty people. We informed them of progress and changes and published the meeting minutes on-line so everyone could access them. We also had to keep the Product Committee informed. They wanted to know what was going to be built when and we told them.

By November the top committee was getting panicky: they were nice, but they were nervous. We never missed a schedule, I changed them and sent out new schedules. I tried hard to protect the team from the pressure from top management. But I sensed that it was like a pressure cooker in the rest of the company. So though I felt bad asking, some of the team had to come in during Christmas time. I tried to report information about progress calmly, and to exude the attitude of it's OK. Still, people felt bad. November, December, January, the machine just wasn't working and everybody felt as though we'd failed. Even though we'd done the impossible. Still, we were late to manufacturing and everyone was scared.

-New Product Team Leader

The decision was made not to separate the team from the rest of the organization. For the project that's a great idea, but for morale and work it's not good. The software people need to learn from other software people. Besides, the software project leader was opposed to separation, having been isolated before and having lost out on career opportunities. So there were lots of one-on-one meetings and sub-group meetings. Lots of people were involved in the project and the Monday morning meetings were too big to get everything done.

At this time we were already two months behind because it had taken longer than expected to get R&D to sign off. I'm not good at power issues. I asked my boss how I was doing and he said OK, but behind. Then things changed a little. They brought in this high-level guy. He has lots of connections with top management and now it's easier to get what we need. My boss asked him to come on, I think, to get more buy-in for the project from the top guys. Besides he's run a project like this before and he's an added resource to the engineers. Also a new level of management has been added in the company. So now there is a new person coordinating our efforts. Although most of these new managers are from R&D this one is from manufacturing, probably because some of the biggest problems this project will have are with manufacturing.

Several rules are in place now, such as minimizing new technology so that this thing gets out in time. We put together this bottom-up process to put together this plan. So now for every piece of the program there exists a plan. And every Monday morning people have to report on where they are with respect to the plan. This makes people accountable. I'm in the middle of two ends of a problem. From above I get major direction and goal setting, like we really don't want to deliver in February but in December, and then in the Monday morning meetings I get reality, here's what we can really do. Lots of work is being done in sub-groups now, like hardware. The team is spread out over four buildings and that's the pits. If you run around with a tape recorder and try to pick up project group things you don't hear a lot. That concerns me. Still, we're continuing to make progress with the machine.

-New Product Team Leader

If people aren't together the project is not going to turn out as good as it could have been. And the analogy I use is when you have a gem--you take a diamond, and you cut it, and you've done all this great stuff--you do a final polishing to it and it adds a sparkle to it and I just have this really strong intuition that that's what's missing because people aren't interacting on a daily basis--they aren't having lunch, they aren't meeting in the hallway to discuss these things, so what's happening is people are in a little more isolated position to make decisions. They end up being more local optimizations rather than project optimizations. I can feel that there's a delay in making decisions. People who are working on the operating system have two things to do. One is they have to do the operating system for the project and the other is that they have to stay in touch with all of the rest of the organization and so they're torn.

-New Product Team Advisor

I decided to house us in some space in an isolated building. This was a novel task, there were lots of new people, and we were going to be going hard and fast. That kind of intensity has to be isolated. I didn't want people to spend too much time there but I knew it would happen so I got four fold-out beds, but I was clear that people would take weekends off and no double shifts. Everything we needed was right there--coffee service, food stand, candy truck.

-New Product Team Leader

In the development stage there again appear to be both external and internal activities. Dependence on other groups decreases because resources and information have already been obtained. Hence transactions across the boundary become less critical. Yet behaviors aimed at coordination with other groups tend to increase. The new product team needs to make sure that other functional groups, those that will provide components and those that take the product over, are working according to the schedule agreed upon. In addition, top corporate management needs to be updated and informed of the product's progress.

An important question during this phase is the degree of separation between the group and the rest of the organization. Specifically, should the team obtain separate facilities or perhaps even physically isolate itself from the

rest of the organization? Related to the question of separation is the notion of protection of the group from outsiders. Isolation of the group, including physical separation, can allow the group to focus on its work but may make it difficult for the group to continue building relationships with other groups.

These external activities occur concurrently with numerous internal activities. The development stage sees the highest need for internal coordination among team members. Members have to work together closely, they need to produce a feasible schedule, deal with external pressures and apparent failures, and create new designs as problems with the old ones appear. It is at this point that the interaction between internal group process and boundary management seemed, to us, most obvious. Isolation may serve to focus the group on its internal process, but it limits the group's ability to coordinate with others and to respond to new information.

Technology Transfer: A Transition Point

By late January large parts of the work were done. There were lots of people working and it was difficult to keep track of who was doing what. There was less control with these new people coming in. Then we had this fight. Manufacturing said let's build it and make repairs later. Engineering said hold it. I was in the middle. Manufacturing yanked these people out. I was in a tenuous position. I wanted the product to stay with the team to get the bugs out, but the Product Committee and the rest of the organization were going crazy. We had made a deal with some customers. There were huge pressures to get it over to manufacturing.

Finally a deal was made with manufacturing and we shipped some machines, and surprise—they weren't working. Meanwhile manufacturing was working three shifts a day, seven days a week. They had quotas to make and we were trying to help them. We had to explain how certain things worked. I had lots and lots of meetings about the status of the project. We wanted some last minute changes on the machine, but manufacturing was not able or not willing to put it in all the machines. There were great arguments and the Product Committee was very involved. By April we had worked out a compromise agreement. By then manufacturing had learned the recipe and the machines were coming out fine.

-New Product Team Leader

DECLARATION OF IMPATIENCE: The time has come, we believe, to call a halt to xxxx engineering and ship the product. This means to seal off all loose ends, cauterize all open wounds, make it reliable, print the documentation, make the kits, and sell it!

We believe it's time to say IT'S DONE!!!! Finish what's there, fix its problems...and ship it. Put the unfinished business on the shelf for 2xxxx. This product already is the best on the market, by far, and the momentum of things to come will insure that it stays that way. BUT NOT IF IT DOESN'T SHIP!

We have a mechanism that is designed to keep a steady flow of improvements, new technology, bug fixes, going to the marketplace. Sell the customer on evolution, not on a solution for all men for all time now....Get on with the "final game." NO MORE DEVELOPMENT!!! Is there something wrong with having developers sit on their hands for awhile? If developers are not sufficiently busy reviewing documentation...then send them on probably much needed vacations/R&R. Just think, if we stopped changing the forms, the functionality and the system it could be measured and tested. If it was finished, we could make it, sell it, and ship it!

-Memo to all people getting xxx to market

The second transition point usually occurs somewhere during the testing phase. The technological problems have been assessed and a prototype exists and has been tested. The transition consists of moving from team ownership of the product to more general organizational ownership. Now organizational groups will begin to take over large-scale production and distribution of the product.

This corresponds to what Quinn and Mueller (1963) would call a technology transfer point, where the emphasis moves from developing the technology to passing information, enthusiasm, and authority to use that technology to other groups in the organization. The transition will not occur if the group is either unwilling to relinquish the product or unwilling to continue to work on the product when it has passed into the hands of others.

This was a difficult transition for all the teams we examined. Problems ranged from members who were unwilling to transfer the product to others, to less committed team members who began work on other projects, leaving the

project before a smooth transition to manufacturing occurred. Managing this transition seems to require careful attention to both internal and boundary processes. The team must the support of other groups for the project yet maintain sufficient internal resources to complete the final development.

Diffusion and Ending

At this point there was work to be done but not as much. The team wasn't meeting much, and I was off in other meetings. People didn't seem to know what to do. It was the end of an intense group. People were burnt-out. People were zombies. People weren't ready to start over, they hadn't recovered. Maybe I should have been doing some career planning, but that's not really what I wanted to do. People were lost. But the product was great. We were starting to get recognition. I sent all my people on vacation.

-New Product Team Leader

At this point the team has a whole different form. Those who are helping manufacturing are spending most of their time in New Hampshire at the factory. That is a small subset of the original team. Some of the team members are going over documentation and support products. There are still a lot of other groups that have to come through for us in order to make this product shine. Then there were quite a few people who left when their part of the project was done. They went back to their functional units or joined other teams. Some did this even before I wanted them to. Then there're a few who have stayed on along with some new people to work on the third generation. We've already got quite a few new features that need to be added and some things that could be done more elegantly. This is sort of a transition from one team to another.

-New Product Team Leader

It is during the diffusion segment that a team's external activities focus on transferring technical data as well as a sense of ownership to the groups that will manufacture and market the new product. The transfer of ownership causes some obvious difficulties for the teams. The nature of the second stage of the development process, particularly if the team has isolated itself, can cause the team to develop a very impermeable boundary. Although the isolation this boundary creates may have been important at that stage, the cohesiveness that it fosters tends to be detrimental for this transfer.

Team members may be out of touch with the rest of the organization and burnt-out from their final push to get the product done, but boundary activities still are essential, particularly with groups who will be responsible for producing and marketing the new product.

Variability of individual involvement with the product will be high at this stage. Some team members will be needed to finish up the project, while others whose contribution has been made will move on to other activities. Issues of burnout, future career moves, and reconnecting with other parts of the organization all need to be handled.

Boundary Processes

It seems clear from comments we have collected that teams manage their boundaries to deal with the different critical contingencies or resource dependencies that they have over time, and to balance internal and external demands. Consistent with an open systems view of groups and exchange theory, the flow of information and resources can be seen as differing on two dimensions: 1) source of initiation of the transaction and 2) the direction of information and resource flow. The teams we observed appeared to be both initiators of transactions and recipients of requests from external agents. They clearly made attempts to model and influence their environment, and to garner resources, whether they be in the form of technical advice or additional manpower. At the same time, other parts of the organization were trying to influence the group, perhaps to include an additional feature, to find out how well the group is progressing, or to encourage the group to get the product out.

Because of these highly interactive exchanges, flows of information, influence, and resources were established between the focal group and its role set (Whetten, 1983). The team or team leader appear to then spend time trying to modify those flows to meet current needs, including co-opting other parts of the organization, bringing them into the group, changing the permeability of the boundary, or trying to reach out and influence external entities to change their demands on the team. In other words, the focal unit and the role set were each trying to set up and manage a flow that met their needs. These flows are not perfect, and with feedback both sets of actors attempted to modify, or influence the flows. The management of this flow in response to task demands becomes boundary management.

Table 1 identifies four boundary spanning roles that appear to capture this exchange notion of the setting up and regulating information, influence, and resource flows. The roles--scout, ambassador, sentry, and guard--may be distributed among members or taken on by one individual. The transactions these members carry out may involve other groups or individuals inside or outside of the organization.

The scout brings information or resources in across the boundary (see Table 1 for examples from the data). These are the activities that have been traditionally associated with the boundary spanner. Examples of the kind of information the scout might collect include task-relevant information necessary for problem solution (is this design feasible?), political data about who supports or opposes the group's activities (what direction does each of the members of the product committee want to take?), and the extent of demand for the group's outputs (Does manufacturing want to get involved with a high volume product right now?). The scout takes on an environmental scanning function. Besides collecting information, the scout procures other resources such as equipment, extra workers, and "home" space.

The scout aids in the adaptation function by providing a picture of the resource constraints, a model of the external environment that provides resources to the team. When resources are readily available, the scout simply procures them; when resources are not easily given the scout gathers intelligence so that the team can begin negotiating to get them. The scout also aids in the goal attainment function by enabling the team to gather information in order to set appropriate goals and then by obtaining necessary feedback on how external agents view progress toward those goals.

The ambassador role involves carrying information, resources, or influence to transmit to others. The ambassador represents the group to outsiders. Representation is the presentation of information by the group about itself to its surrounding environment in order to shape beliefs and behavior of others (Adams, 1976, 1980). This is a form of profile management. As the data indicate, the team is not passive. There are numerous attempts by all groups to reach out and influence the team's ideas and output. The ambassador develops and maintains channels of communication that explain the group's activities to powerful outsiders and help persuade these outsiders that the group's activities are valuable and should be supported. Table 1 shows examples of the ambassador role from the data.

Kanter (1983) describes these ambassadorial functions as getting others to commit themselves to, or share the goals of, the group. In Parsons' terms, this role can be viewed as fulfilling the function of adaptation. In this case adaptation is not simply internal change in response to external demands, but rather an attempt to exert influence to change those external demands to match internal goals. One example in our data is the product team leader's attempt to make manufacturing wait until product modifications were completed. The ambassador role contributes to the goal attainment function in trying to

convince external evaluators to reassess project goals (changing due dates), thereby making the team seem farther ahead than it is.

The role that establishes permeability of the group's boundary is that of the sentry. The sentry polices the boundary by controlling the information and resources that external agents want to send into the group, acting as a filter deciding who can give input, how much of that input will be admitted, and when the flow of input must stop. A good example of this role is the team leader who tries to protect the team from the pressure of top management by bringing in only selected information about what is going on in the rest of the organization (see Table 1). The sentry protects the group by allowing it to work with minimal distraction. External entities will want to communicate their priorities, interests, and demands. When this input is desired, the job of the sentry is to allow entry. When this information and other inputs are not desired, the job of the sentry is to buffer the group (Thompson, 1967). The sentry absorbs external pressures, such as political tensions, on behalf of the group. An extreme form of buffering is actual physical separation of the group from the organization.

One area that is difficult for a team to make decisions about is the extent to which the team should be isolated. While tighter boundaries allow for greater efficiency in the internal functions of integration (coordination of effort) and pattern maintenance (the establishment of a set of values to guide behavior), this boundedness may cut individuals off from career opportunities and also inhibit adaptation to changing organizational and environmental conditions. This is consistent with research that shows underbounded systems often have unclear authority structures, and difficulties harnessing energy to do work and communicating among members (Alderfer, 1976). By controlling the flow of information, influence and resources that outsiders

try to push into the group, in effect the sentry makes trade-offs between internal and external effectiveness.

External entities may well be curious about group activities or products or envious of group resources. The guard monitors the information and resources that others request from the group and determines what the group will release in response to these demands. The guard role is reactive; and it requires judgment to determine if it is in the group's best interest to let information out of the group. The team may be conscious of its profile so that it releases positive information to those who are needed for future support ("help us, we're the next generation") and keeps silent with competitors ("don't let anyone from that other company know anything about the status of this project").

These boundary roles are inter-related. The scout and sentry roles both deal with input to the group. As such, both roles influence group member perceptions of the outside world, because they are likely to filter, consolidate, and interpret external inputs, potentially distorting them in some way. Similarly, the ambassador and guard roles influence how external entities perceive the group. They determine what is said and how to those outside the group. Such roles may require a high degree of diplomacy for correct communication of sensitive information and marketing skills to "sell" the group's position. While the sentry and guard have to deal with initiatives from other parts of the external environment, theirs is a reactive role. In contrast, the scout and ambassador represent initiatives on the part of the group to increase the flow of inputs and outputs it receives. Thus, the roles must act in concert.

These roles can all be taken on by one individual, or many different people can play the same role. A sequence of boundary activities also may require elements of more than one role. For example, the group leader may assume all boundary activities. Roles may be combined; someone in the position of ambassador also may carry out scouting. The leader may ask each group member to play the role of guard to keep certain information secret.

Boundary Management-Performance relationships in New Product Teams

Thus far we have combined our data with concepts of resource dependency and exchange theory to broaden the scope of boundary activity beyond the boundary spanner who imports technical information. We organize data in the four-role framework: the scout, ambassador, sentry and guard, who monitor the flow of technical, market, and political information, influence, and resources. The data are descriptive, but the resource dependency concepts allow us to consider some normative propositions.

These propositions are based on the assumption that the new product team depends on different parts of the organization at different times, for different types of transactions. Therefore the amount and type of boundary activity must change over time. In addition, the relative importance of internal and external activities changes over time to reflect the complexities of changing task demands.

During the creation phase the team needs the input of technical, market, and political information. The team, or the several people who will later form the team, are dependent on other parts of the organization for ideas, for support, and for cooperation. The team also depends on top management to give it resources, on marketing and engineering for market and technology ideas, and on many other groups for promised support over time.

Proposition 1: In high-performing teams, during the creation phase, scout and ambassador activities will be higher than in low-performing teams.

When the primary task of a group is to gather inputs, and some of the necessary information, resources, and expertise are outside the group, high-performing teams will increase scout activity. When the group's actual survival is on the line, and political information is necessary, the scout can obtain data about top management support and procure resources. In the meantime, ambassadorial activity serves to maintain support from those who have given it, as well as tries to obtain it from those who oppose the group plan. Cooperation and support that are cultivated early can help the group later.

In Parsons' (1959) terms, at this early stage there is considerable need to adapt to the current priorities of the organization and to set goals in line with the rest of the organization. Clearly, internal functioning is necessary as well. The group needs to determine product feasibility and set an initial structure and tone. So while some sentry and guard activity are needed to allow the group time to coalesce, we propose that in high-performing teams this activity is limited in early stages to prevent rigidity and premature closure on a product idea and team structure.

Once organizational commitment is there and the funding sources have agreed to the project, dependency decreases and the task shifts from product definition and gaining support to actual development. We propose that at this phase of product development scout and ambassador activity can decrease. External entities have to be kept informed to coordinate work activities, but internal group functions begin to play a more important role. The team needs to be protected from external interference to enable it to coordinate and innovate.

Proposition 2: In high-performing teams, during the development phase, sentry and guard activities will be higher than in low performing teams.

It appears that separation and seclusion from the rest of the organization can improve the efficiency of the team. Constant interruption about product features or questions about progress distract team members from work. Hence, the sentry and guard come into play. Scout and ambassador activity is still required but to a lesser extent. Toward the end of this phase of activity, dependency on manufacturing increases again which will require more of these activities.

In Parsons' (1959) terms, the team has taken care of primary external functions of adaptation and goal attainment and now must move to an internal emphasis on integration and pattern maintenance. Well-developed intra-group coordination and quick responses are needed to deal with unexpected failures and technical problems, so the team must find a way to work together in an efficient manner. In other words the team knows what the external demands are, and has set up some promised exchanges with interdependent external entities--now it must configure the group to produce the product.

In the final diffusion phase and the technology transfer transition, a more open boundary is again needed. No longer is innovation and coordinated response to technological problems as important as creating demand for the group's product in other parts of the organization.

Proposition 3: In high-performing teams, during the diffusion phase, ambassador activity will be higher than in low-performing teams.

While internal management is also needed at this time, the external activities are likely to be of greater importance. Again dependency is high; if these external groups do not take the team output at the appropriate time and with a high degree of commitment, all the team's efforts could be lost. In Parsons' (1959) terms, adaptation and goal attainment become dominant functions. The criticality of each role changes depending upon the demands of the task at a particular phase of development.

Implications for Team Management and Future Research

Much of the current literature on group functioning suggests that team leaders spend their time fostering good internal processes such as effective decision making, supportiveness, and trust (Argyris, 1966; Dyer, 1977; Zander, 1977). There is no question that while these processes are important in team management, we have shown that another aspect of group process deserves study. New product team leaders, and the leaders of all groups that are interdependent with external entities, must successfully manage a complex set of boundary activities as well if the group is to be effective.

We have identified four roles that delineate these boundary activities. The scout, ambassador, sentry, and guard accomplish the myriad transactions with the external environment. Roles will not always be taken on automatically. Hence, we propose that in resource-dependent environments the team leader must assign these roles to group members and evaluate them on their performance in these roles. Role performance is also influenced by the organizational context. The team leader must work to make organizational reward and control mechanisms encourage and reward effective role behavior.

The team leader has to be very sensitive to changing task requirements and changing dependencies and able to use boundary activities to help meet those demands. When the team is very dependent on outsiders, a temporary network needs to be set up to ascertain what those demands are, how the groups can influence or change the demands to be more congruent with its needs, and how the group has to shift internally to meet the demands. When this network activity begins to interfere with internal coordination and innovation, the team leader needs to consider making the boundary less permeable to protect the team, perhaps shifting team activity and modifying the network with the external organization to respond to demands. The leader also must learn how to decide if these external dependencies have to be dealt with through boundary transactions or whether members of that external world should be brought into the group (bringing in manufacturing personnel to be part of the team early on, for example). Perhaps added to the list of roles are hostages, and immigrants.

The data presented here have implications for research as well as for management. First and foremost, we studied teams within their organizational context in order to examine boundary as well as internal processes. We advocate that approach for further research. Also inherent in the propositions is recognition that groups should be monitored over time and their interactions monitored both across levels in the hierarchy and across functional lines. Finally, and perhaps most important, a careful analysis of the group task is needed for good results. In accordance with Goodman (1986), we believe that this task analysis would do well to go beyond the abstract, one-dimensional categorization—e.g., high complexity—to a clearer description of actual task activities and demands.

Perhaps the most interesting implication is that our models of group development need to be reexamined. We need to add adaptation and goal attainment to our developmental models of resource-dependent groups. Clearly the data indicate that these functions are a factor in team survival. Many questions remain, however. How do these external functions develop in conjunction with internal ones? Do all groups need to model their external demands and hence adopt adaptation as the dominant function in the first phase of development? Or is this developmental pattern a function of the teams in this study? We must not only explore how individuals adapt to the group, but also how the group adapts to the organization and integrates individual members. Other questions emerge: Do open and closed groups have different developmental patterns? Which is the more effective?

In a sense, these data suggest that the whole definition of group be reexamined. Each team we have described is really several groups. Group membership changes over, and the extent to which groups are part of an ever-changing larger network shifts over time. Are these the "same" groups?

Research on groups needs to focus on how to put together groups and take them apart quickly. It needs to address how to develop and shift external networks. It needs to better illuminate how permeability, separation, incorporation of external parts of the organization, modeling of the external environment, and influence of the external environment can influence effectiveness.

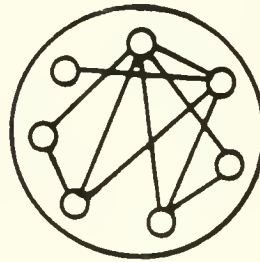
Future research in this area may disprove the contention of Hackman and Morris (1975) that we still know very little about what makes one group better than another.

Notes

1 Although most of the team leaders we spoke to fell into this mold of general support and even initiation from top division or corporate management, this was not always the case. Two groups in particular had very different beginnings. Basically, one group's product idea came from an engineer who got some of his friends to work on it with him as a back burner project; his manager thought it might have some potential but wasn't overly enthusiastic. This small group of engineers got all the specs done, scraping together time and resources as well as they could. For this latter group, development time was short but the transition phase into a funded, company-supported project was more difficult than comparable groups with external support. A second group was put together by a product champion who had developed the product idea as part of a business school project and then convinced an R & D V.P. to hire him to bring the product through to production. These two groups follow the more familiar product champion model.

FIGURE 1

Groups in Isolation



Groups in the Organizational Environment

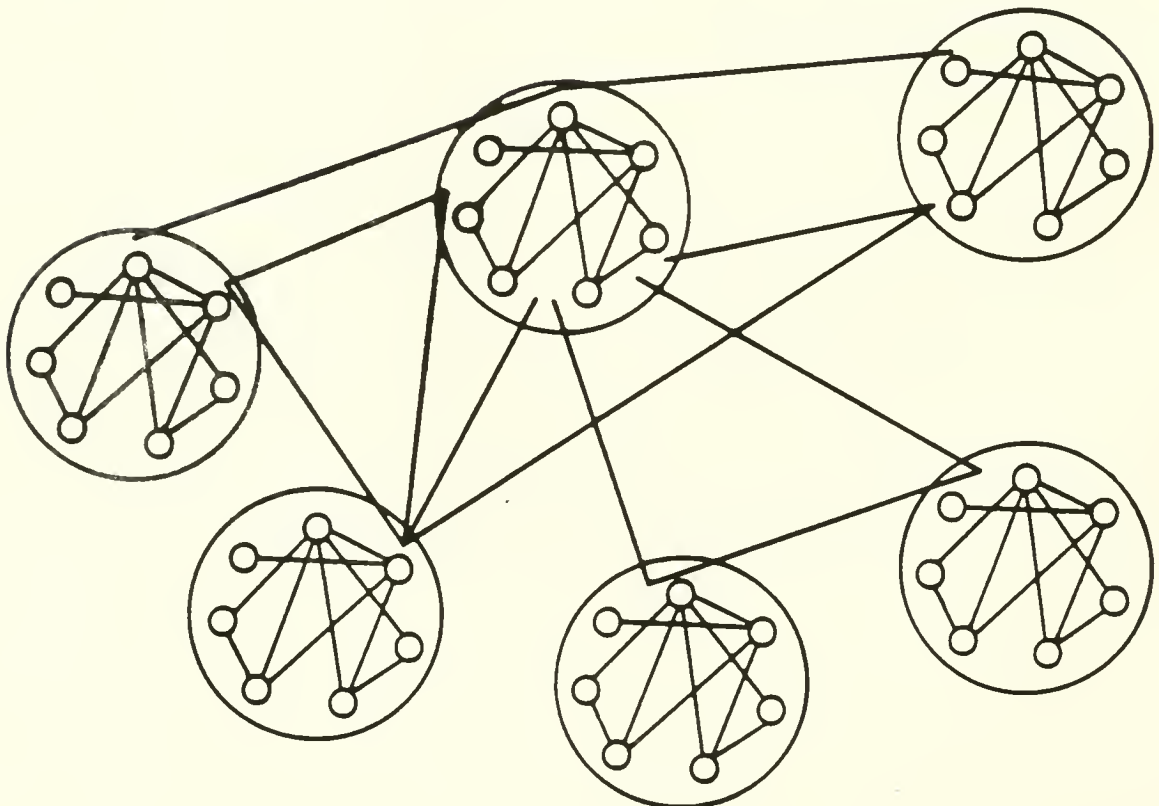


FIGURE 2

PHASES OF NEW PRODUCT DEVELOPMENT

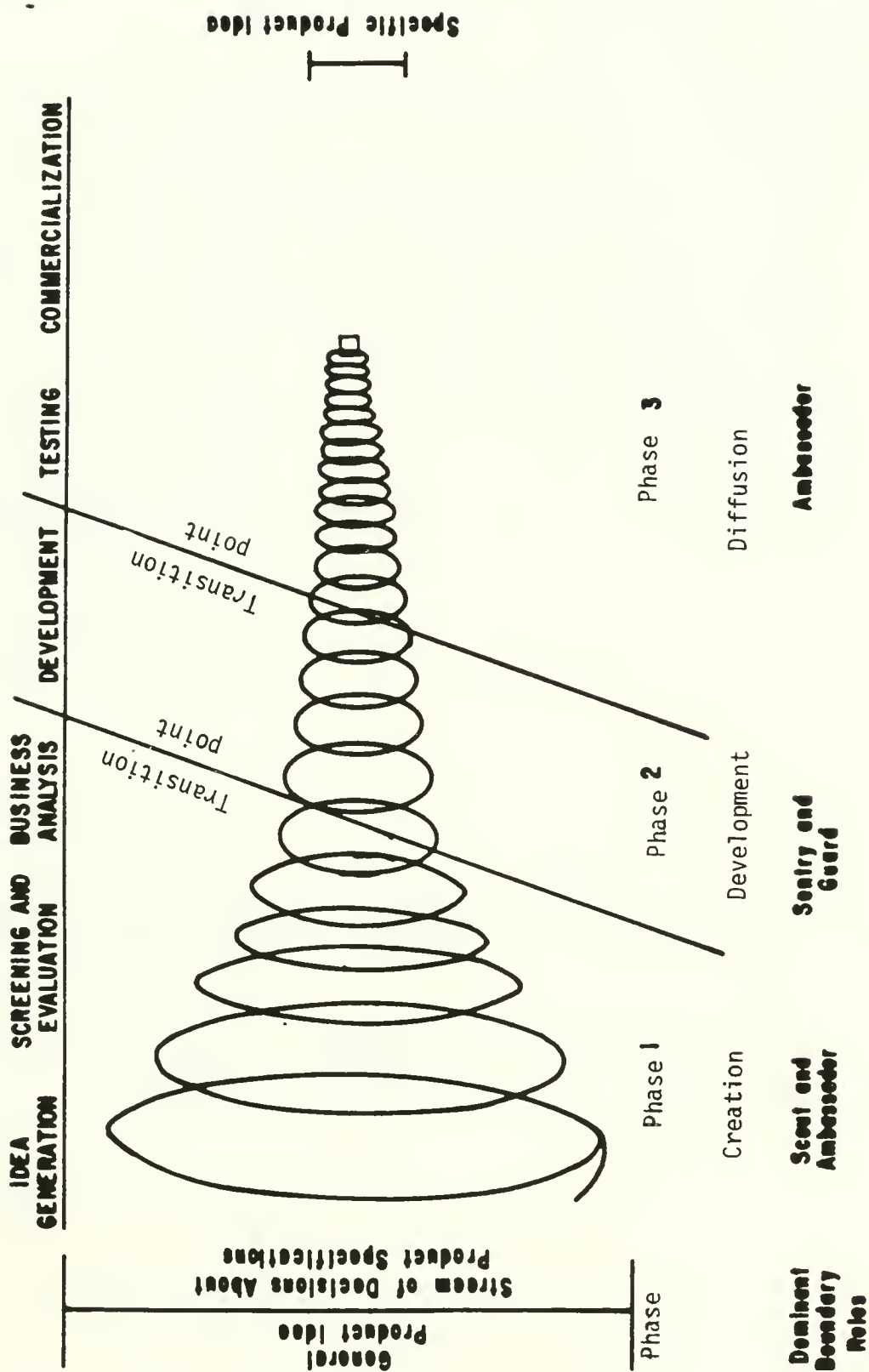


TABLE - EXAMPLE OF BOUNDARY ROLES

<u>Scout</u>	<u>Ambassador</u>
"I came back to the group once per week for a staff meeting....I got news and went back to my team with 'letters from home'." I would go around to the other groups to see what was going on. There was a great deal of coordination to take care of and this way I could make sure that components were ordered well enough in advance so that we could get the product out on time." "We have a kind of detector. She's very sensitive and works with the people interfaces not the technical part. She spends time with all the groups in manufacturing to detect problems so that they can be dealt with quickly."	"Then we started having meetings with all of those people outside the group. There were representative from purchasing, manufacturing, production planning, the diagnostics group, marketing, everyone. This was an opportunity to give information and hear about new business. Everyone was informed about progress and changes. The minutes were typed on line so that the team and those who weren't at the meeting knew what was going on. The top management group also got copies." "I go down to where the project first hits and tell 'em what's coming down. I say that four things are coming, and this is the most critical. You can't always say rush, rush, rush." I stop in even when there's nothing urgent. to develop a relationship with those people. I send them minutes of our meetings and when the project gets closer I send them memos explaining what's required and asking them what they need from us." "I'm like a cheerleader, trying to get those guys excited about our products. But I tickle our group too; I'm not going to carry over some half-baked ideas. They'd get tired of that real quickly."
<u>Sentry</u>	<u>Guard</u>
"We needed to get input from engineering at the beginning. We didn't want to come up with some kind of Dr. Seuss machine that had to be redesigned later so we let the engineering people in." Near the end I talked to the top management group a lot. I tried to protect the group from that kind of pressure though. It's like Tom West said, "we won't pass on the garbage and the politics."	"So we set up living quarters and moved the team away. That kind of intensity needed to be isolated. People kept coming over and saying, "How's it going? What are you up to now? This was at best distracting, at worst like being in a pressure cooker." "Near the end people started panicking. The top guys would come down and want to know if we were making progress. I told them they had to stop, that they were having a distracting and deleterious effect on the group."

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